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PART 1.

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[With Twelve Plates and One Folding Table, illustrating Papers by Miss M. K. Heslop & Dr. J. A. Smythe, Mr. E. S. Cobbold, and Mr. S. S. Buckman.]

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EVENING MEETINGS OF THE GEOLOGICAL SOCIETY TO BE HELD AT BURLINGTON HOUSE.

Session 1909–1910.

1910.

Wednesday, March ..... 9*—23
,, April ..... 13*—27
,, May ..... 11*—25
,, June 15*

[*Business will commence at Eight o'Clock precisely.*]

The dates marked with an asterisk are those on which the Council will meet.

Yeovil Sands, the main mass of the Bridport Sands, and the Midford Sands in a strict sense, being post-striatulan would be, therefore, Yeovilian. Owing to a non-sequence in the Yeovil district, the finish of the Yeovil Sands coincides with the end of the Yeovilian, which makes the name appropriate; but, there being a due sequence in the Bridport area, the upper part of the Bridport Sands is later than Yeovilian: it is Aalenian.

VI. Summary.

(1) Descriptions are given of certain strata (Lower Bathonian to Pliensbachian) on the Dorset coast—Chideock and Burton Bradstock.

(2) Comparison is made with similar strata inland—with a summary of beds at Stoke Knap; with certain North Dorset strata; and with Toarcian beds of Yorkshire and Northamptonshire.

(3) The strata described are classified according to what may be called the multizonal or polyhemeral system—in the main, according to the scheme introduced for these strata in 1893[1]; but further divisions due to other investigators and to myself are dealt with.

(4) The strata described are arranged among thirty-six zonal (hemeral) divisions—a greater number of divisions than Oppel used in 1856 for all the Jurassic rocks, of which these beds form but a small part.

(5) The Upper Lias part of the Junction Bed of Down Cliffs, Chideock (Lower or pre-*striatulus* Toarcian), is a very condensed, imperfect epitome in 20 inches of about 180 feet of strata on the Yorkshire coast, and of very much more when allowing for gaps.

(6) Between the *bifrons* layer and the *striatulus* layer of the Junction Bed there is occasionally a 2-inch layer which is all that represents some 250 feet of deposit in the Cotteswolds—so that about 2 feet of Junction Bed was formed while a thickness of some 550 feet was being deposited elsewhere.

(7) The Upper Toarcian (*moorei-Dumortieriæ* hemeræ) makes a great showing at Burton Bradstock and Down Cliffs as the Down Cliffs Clay and Bridport Sands (*pars*), the greatest thickness of rocks of these dates in the kingdom.

(8) The sequence of *aalensis* strata above *moorei* beds is demonstrated at Chideock Quarry Hill, in the upper part of the Bridport Sands.

(9) The Inferior Oolite (Aalenian, Bajocian, Bathonian, *pars*) strata of Burton and Chideock are not counterparts of one another: they supplement each other to a certain extent; both are incomplete and much epitomized representations of thicker deposits elsewhere.

(10) Mr. Beeby Thompson's zonal scheme for the Upper Lias is considered, and a table of Upper Lias zones for future work is presented.

[For the Discussion, see p. 109.]

[1] Quart. Journ. Geol. Soc. vol. xlix, p. 481.

4. *Certain* Jurassic ('Inferior Oolite') Species *of* Ammonites *and* Brachiopoda.

By S. S. Buckman, F.G.S. (Read November 3rd, 1909.)

[Plates IX–XII.]

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I. Introduction.

The species described or mentioned in the following pages have a more or less definite connexion with the Jurassic strata of the Dorset coast described in the foregoing paper[1]; but, although this communication is offered as an Appendix to that one, it may perhaps more rightly be regarded as an Appendix to that and the other communications on similar strata mentioned on p. 53.

The Inferior Oolite rocks are so remarkably prolific in species of Mollusca and Molluscoids—there is so great a number of species yet awaiting description—that there seems to be an idea among those who have not studied the rocks in the field, that they receive a kind of preferential treatment in this respect. Another explanation may be suggested—that our judgment as to the time occupied in the forming of the so-called 'Inferior Oolite' strata is warped owing to their tenuity—that they represent a time during which destruction of strata was particularly active, therefore the remaining deposits are only the fragmentary representatives of a whole.

This is particularly the case in Dorset. A schoolboy once defined a net as a series of holes strung together, and the Dorset Inferior Oolite might be defined as a series of gaps united by thin bands of deposit. And one reason for the prolificness of the deposits is that the amount of deposit can be no indication of the amount of time, as shown by the changes in successive faunas; and also that the deposits are so local—the deposits of one place correspond to the gaps of another. Therefore many localities have to be placed together to produce the full tale of the Inferior Oolite. The very local distribution of Inferior Oolite species often means that strata of particular dates have only been preserved in a few favoured localities.

The beds of the 'Inferior Oolite,' in a restricted sense, have now been divided as deposits of about twenty-two successive dates or hemeræ.[2] The total for the whole of the Jurassic would not be more than about eighty-five, or perhaps, on an extended scale, a

[1] Alluded to as 'the stratigraphical paper.'

[2] See the stratigraphical paper, p. 55.

hundred hemeræ. Therefore, according to this reckoning, the few feet of Inferior Oolite represent from about a quarter to a fifth of the total time occupied in the deposition of the entire Jurassic System.

One can hardly view the few feet of Inferior Oolite limestone at Burton Bradstock, about 15 to 20 feet say, and imagine that it represents an interval of time equal to a quarter or a fifth of the whole Jurassic Period—a time during which thousands of feet of strata were laid down. But this is because we do not allow sufficiently for the gaps.

If anything like this supposition be correct, then the Inferior Oolite prolificness is understandable : it should represent in species as many as would form from a quarter to a fifth of the total for the Jurassic System. At that rate, its tale is nothing like complete yet ; which all workers in its rocks know to be the case.

For most of the photographs of Ammonites which illustrate this paper, and for all the photographs of Brachiopods, I desire to express my best thanks to my enthusiastic friend, Mr. J. W. Tutcher, whose excellent work I have acknowledged on other occasions ; but all such acknowledgments and thanks fall very far short of the measure of my indebtedness to him.

In the descriptions of some of the following species of Brachiopoda, the consequences of a former lack of zonal divisions of strata will be noticed. Because the top beds of the Inferior Oolite—from *Garantiana* to *fusca* in some cases, from *truellii* to *zigzag* in others —were called simply *parkinsoni* zone, the dates of some species are uncertain within these limits : that is to say, which species are truly contemporary and which are successive, was not properly noted at the time of collecting, because the strata were grouped too comprehensively.

II. Descriptions of Ammonites.

Family **Amaltheidæ** (subfamily **Sonnininæ**).

Genus Shirburnia,[1] nov.

Definition.—Whorls stout, trigonal, with considerable inclusion. Ornament coarse, but showing rapid decline to levigate stage. Carina distinct, not large, hollow. Suture-line not complex ; superior lateral lobe broad-stemmed, short. Lobules short, inequipoised ; terminal lobule endobrachysceles ; inner lobes not dependent.

Distinction.—From *Sonninia* (*S. propinquans* series), the stout whorls, the rather small carina, the not complex suture-line, the broad-stemmed superior lateral lobe. From *Dorsetensia*, of which

[1] Sherborne (Dorset), where the species of the genus are found ; but I would also like to associate with the name my kind friend, Mr. C. Davies Sherborn, as a small expression of thanks for his invaluable bibliographic assistance on many occasions.

the suture-line has somewhat this pattern, but is less lobulate, the stout whorls, the coarse ornament, and the smallish carina, are distinctions.

In *Sonninia* the whorls are much compressed; the carina is very strong—it is distinctly an alticarinate genus; the suture-line is very complex; the lobes are long; the superior lateral lobe is narrow-stemmed. In *Dorsetensia* (*D. liostraca* series) the whorls are much compressed and the carina is very strong; but the suture-line is of a type much simpler than in *Shirbuirnia*. From the '*Sonniniæ* of the *concavum* zone' there is no need to consider the various distinctions, because they ought to be separated from *Sonninia*. From *Dorsetensia edouardiana*, which is the type of the genus *Dorsetensia*, there is also little need to consider distinctions; the regular costate stage and the absence, except on inner whorls, of a tuberculate stage, show the different line of development in that case.

SHIRBUIRNIA TRIGONALIS, sp. nov. (Pl. X, figs. 2 & 3.)

Description.—Gradumbilicate; ornament-stages irregularly tuberculate-costate, declining to levigate.

Remarks.—The inner whorls show various small costæ, with occasional irregular, inner marginal nodi. Later these ornaments decline into complete smoothness.

The trigonal shape of the whorl gives a pronounced wall to the umbilicus. Specimens of this species have lain in my cabinet, with the description now given, for some dozen or more years awaiting description. The species is interesting, because its fellows are found in Würtemberg[1]; and because the fauna which they typify is only found in perfection in one place in England, namely, at Sandford Lane Quarry, Sherborne (Dorset).

Locality and stratum.—Dorset, Sherborne, at Sandford Lane Quarry, in the bottom part of the Fossil Bed; Bajocian.

Date of existence.—*Sonniniæ* hemera. This should now be altered to hemera of *Shirbuirnia trigonalis*; for *Sonninia* sensu stricto belongs only to the *sauzei* hemera.

The holotype of this species is a large adult specimen, which could not be adequately figured in these pages. It is about 325 mm. in diameter, showing little else than a smooth catagenetic stage. The umbilicus expands in the last turn, attaining a breadth of 120 mm. The whorl-section becomes more and more trigonal or galeatiform with age, the breadth of the whorl just about the inner margin being about 98 mm., making allowance for the thick test which borders the umbilicus. The umbilical bordering wall becomes very conspicuous.

The paratype specimen, of which figures are given (side view $\times 0{\cdot}86$ and front view $\times 0{\cdot}61$), shows the nodaticostate stage of the inner whorls (the nodi being somewhat irregular swellings on the inner margin) passing into the levigate stage.

[1] See the *Ammonites sowerbyi* fauna figured by Quenstedt, 'Amm. Schwäb. Jura' 1886, pls. lxi & lxii. *A. sowerbyi gracililobatus* is possibly a *Shirbuirnia*.

Another species of this genus is

SHIRBUIRNIA STEPHANI (S. Buckman).

1882. *Amaltheus (?) stephani*, S. Buckman, 'New Species of Ammonites' Proc. Dorset N. H. & A. F.-C. vol. iv, p. 138 & pl. i, fig. 1.

This species is angustumbilicate, the whorls being occluded almost to the inner margin; but the slopes of the inner margins being convex, it cannot be described as concavumbilicate. The species is wholly levigate, and shows nothing of the tuberculate stage. It differs therefore in umbilication and in ornament from *Sh. trigonalis*; but it differs really because it has inherited at an earlier date the senile characters of that species. It shows the same characteristic suture-line, and the trigonal whorl-section is fairly marked. The type specimen has the complete mouth-border, quite plain, with a slight peripheral projection.

This species comes from the same beds and the same place as *Shirbuirnia trigonalis*.

Genus **Sonninia**, Bayle.

SONNINIA SUBTRIGONATA, S. Buckman. (Pl. XI, figs. 4–6.)

This species was described in 'Descent of *Sonninia* & *Hammatoceras*' Quart. Journ. Geol. Soc. vol. xlv (1889) p. 659; but it was not figured, as it was supposed that it would soon be illustrated in my Monograph of the Inferior Oolite Ammonites. As that supposition has not been realized and is not likely to be accomplished, and as Mr. Tutcher has kindly made photographs of the type, it seems desirable to give the illustrations now, to show what an alticarinate *Sonninia* (a true *Sonninia*) is like, such as is mentioned in the stratigraphical paper, p. 55.

Locality and stratum.—[Sandford Lane] Sherborne (Dorset) [from the *sauzei* zone by matrix]; see Quart. Journ. Geol. Soc. vol. xlix (1893) p. 492, Bed J *a*.

Family **Oppelidæ**.

Genus BRADFORDIA,[1] nov.

Type BRADFORDIA LIOMPHALA, sp. nov.

Definition.—Compressed, involute, keelless; inner area more or less sunken to a shallow sulcus, bordered by a more or less raised rim at the edge of the concave inner margin. Radii wide-angled, v-script, without peripheral projection, passing on to the periphery and more or less distinctly over it.

Distinction.—The absence of the carina distinguishes the genus from *Oppelia*; and the concave inner margin with its rim bordering a depressed zone distinguishes it from *Lissoceras*, which also shows a different run of radial line—sigmoid with peripheral projection.

[1] Bradford Abbas.

BRADFORDIA LIOMPHALA, sp. nov. (Pl. X, figs. 4 & 5.)

Description.—Whorls much compressed, especially around the umbilicus, which is smooth and gradate with an ill-defined rim. Ornament not strong: costæ on outer two-thirds of whorl, inner third almost smooth.

Remarks.—This species has lain in my cabinet for some twenty years, with the trivial name *liomphala* attached. It first attracted attention on account of its remarkable likeness to some of the concavumbilicate, or rather subconcavumbilicate Ammonites—species of the type of *Ludwigella concava* (Sow.), *Graphoceras v-scriptum*, S. Buckm., etc., which were all once known as *Ammonites concavus*, Sowerby. These are all keeled species of the family Hildoceratidæ; but when this species lay in the rock with its keelless periphery hidden, it was doubtless often passed over as 'only a common *A. concavus*.' This perhaps accounts partly for its rarity; but when the keelless condition was noted, and search was made for the species, no more than some twenty specimens were the reward of much collecting, though the *concavus*-like ammonites were obtainable by hundreds.

To *Platygraphoceras apertum*, S. Buckm., *Graphoceras limitatum*, S. Buckm., and especially to *Pseudographoceras compressum*, this species bears very great resemblance. In fact, in relation to the latter it is almost a case of isochronous homœomorphy. The distinction in all those species is a keel and a costate umbilicus.

From *Oppelia subplicatella*, Vacek,[1] pl. xi, figs. 2 & 3 (which seem not to be the same species as his pl. xi, fig. 1), the different direction of the ribs is sufficient distinction. With *O. subplicatella* (fig. 1) the different size of umbilicus and the different thickness of whorls prevent any comparison.

Locality and stratum.—Bradford Abbas (Dorset), from the Fossil Bed: and certainly by matrix from the upper part; Stoford (Somerset), from a similar bed.

Date.—*Discitæ* hemera.

BRADFORDIA COSTATA, sp. nov. (Pl. X, fig. 6 & Pl. XI, fig. 1.)

Description.—Whorls comparatively stout (for a species of this genus); ribs somewhat coarse; umbilical rim small, but distinct.

Distinction.—From *Bradfordia liomphala*, stouter whorls and coarser ornament.

Locality and stratum.—Bradford Abbas (Dorset), in the upper part of the Fossil Bed. Zone of *Hyperlioceras discites* (Bajocian).

BRADFORDIA INCLUSA, sp. nov. (Pl. IX, figs. 2 & 3.)

Description.—Compressed, much included; umbilicus small; depression on the inner area of the whorl distinct, making the umbilical rim distinct.

[1] 'Ueber die Fauna der Oolithe von Cap San Vigilio' Abhandl. k.k. Geol. Reichsanst. vol. xii (1886) p. 82.

Distinction.—From *Bradfordia liomphala* or *Br. costata*, the smaller and deeper umbilicus, which gives to the central area a quite distinct appearance. The whorl is stouter than that of *Br. liomphala*, but almost as stout as that of *Br. costata*; the degree of costation, however, agrees with that of the former.

Locality and stratum.—Stoke Knap (Dorset), from the Building-Stone. It is most likely from the top layer, and so it may be of the date of the post-*discitæ* hemera.

Note.—*Oppelia preradiata*, Douvillé,[1] is not a *Bradfordia*, though there is much likeness to *Br. inclusa*; for Douvillé describes the ribs of his species as being slightly turned forwards, and ending abruptly on the edge of the periphery. These are not characters of *Bradfordia*: and in *Br. inclusa* especially the ribs meet about the central line of the periphery, but they are alternate, not opposite.

Bradfordia etheridgii (S. Buckman).

1882. *Haploceras etheridgii*, S. Buckman, 'New Species of Ammonites' Proc. Dorset N. H. & Ant. F.-C. vol. iv, p. 143; *Œcotraustes* (misprinted *Occotranstes*), pl. iii, fig. 3.

Remarks.—This species may be regarded as a *Bradfordia*. It has the umbilical rim and general appearance of the other species; but its whorls are stouter and more involute.

Localities and strata.—Bradford Abbas (Dorset), from the Fossil Bed, and presumably the upper part. Dundry (Somerset), apparently, by matrix, from the Limestone and Marl beds.

Date.—Presumably *discitæ* hemera.

Genus Œcotraustes, Waagen.

Œcotraustes spiniger, sp. nov. (Pl. XI, fig. 7.)

Description.—A much compressed, rather widely umbilicate, and almost smooth Oppelid, with a flattish uncarinate periphery. The only ornament is some obscure falcate parvicostæ, and on each edge of the periphery, for a part of the outer whorl, a row of small tubercles. The mouth-border shows the base of a lateral linguiform projection.

Distinction.—This species is something like *Œcotraustes serriger* (Waagen)[2]; but is thinner, with a narrower and more definite periphery, has a large umbilicus, and a different arrangement of tubercles. Our species has a superficial resemblance to some of the *Bonarelliæ* of the Oxfordian; but the ribbing is different.

This species has much likeness to *Oppelia echizenica*, Yokoyama[3]; but that has larger and more distant peripheral tubercles, possesses a keel, and a different whorl-section. And as it is very different in date, being Oxfordian or post-Oxfordian, the resemblance probably is only accidental.

[1] Bull. Soc. Géol. France, ser. 3, vol. xiii (1884–85) p. 33.

[2] 'Die Formenreihe des *Amm. subradiatus*' Geogn. Pal. Beitr. vol. ii, pt. ii (1869) p. 230 & pl. xx, fig. 8. His fig. 7 appears to be quite another species.

[3] Journ. Coll. Sci. Tokyo, vol. xix (1904) art. 20, p. 8 & pl. i, fig. 7.

Remarks.—This species is interesting, as being about one of the earliest of the Oppelids to develop periphero-lateral tubercles: there are apparently successive independent developments of such 'spinigerous' forms as *Œcotraustes*, *Oppelia*, *Hecticoceras*, *Bonarellia*, and *Taramelliceras*. The actual earliest form is probably *Oppelia (Œkotraustes)* sp. nov. indet., figured by Vacek from the Oolite of Cap San Vigilio.[1] That Oolite is evidently, judging from the Ammonites, of varied dates, extending from *aalensis* to *discites*: the latter, probably, is the date of Vacek's unnamed form.

Locality, etc.—Frogden Quarry, Oborne (Dorset), in the Marl Bed with green grains; Dundry (Somerset), in the Ironshot Oolite. Its date is therefore *sauzei* hemera (Bajocian). It is rare. It might be expected in the Red Beds of Chideock Quarry Hill; and perhaps at Burton.

Family **Hildoceratidæ**.

Genus Darellia, S. Buckman.

For description of the genus and species, see 'Monogr. Inf. Ool. Amm.' (Palæont. Soc.) Suppl. 1904, p. cxii.

Darellia alta, sp. nov. (Pl. XI, figs. 2 & 3.)

Description.—One of the carinatitabulate Hildoceratids, much compressed, with a small narrow-stepped umbilicus, and ornament passing from obscuricostate to levigate.

Distinction.—From *Darellia polita*, the smaller umbilicus, the narrower periphery, and the more elevated carina.

Remarks.—This is one of the rare and interesting Cotteswold species which serve to show that the Lower *Trigonia* Grit of the Cotteswolds is contemporaneous with certain strata in Dorset.

Localities and strata.—Frith Quarry, near Painswick, Gloucestershire (Cotteswolds), Lower *Trigonia* Grit; Dundry (Somerset), Limestone and Marl Beds; Stoke Knap (Dorset), in the Building-Stone: all these would be strata of the zone of *discites*. Mr. Charles Upton possesses a specimen from Rodborough, Gloucestershire (Cotteswolds), presumably from Lower *Trigonia* Grit, which is abnormal on one side, apparently a reversion, due to injury, to the style of *Darellia semicostata*.

Genus Œdania, S. Buckman.

For description of the genus and species, see 'Monogr. Inf. Ool. Amm.' (Palæont. Soc.) Suppl. 1904, p. cvii.

Œdania obscura, sp. nov. (Pl. IX, figs. 4 & 5.)

Description.—This is one of the carinatitabulate Hildoceratids; but the keel is small. It is a thin form, though the body-chamber shows a tendency to thicken; the umbilicus is small, step-form; the ornament consists only of obscure falcate ribs.

[1] Abhandl. k.k. Geol. Reichsanst. vol. xii (1886) pl. ix, fig. 13.

Note.—In the side view the umbilicus is imperfect, and so appears too large: the dots show the true position of the inner margin of the last part of the whorl, giving an inclusion of about half a whorl.

Distinction.—It is separable from any other species of the genus, by the deficiency and paucity of its costation, as well as by other characters.

Locality and stratum.—Bradford Abbas (Dorset), from the Fossil Bed; three specimens, whereof the one figured is the largest. It is evidently from the *discites* zone, and there is reason to think that it occurs in the Yellow Conglomerate Bed of Burton Bradstock.

Family **Hammatoceratidæ**.

Genus Burtonia, nov.

Whorls stout, inclusion considerable; ornament when present coarse; carina small, solid; suture-line not ornate; superior lateral lobe somewhat long, broad-stemmed, trifid; inner lobes much retracted (dependent)—running back and pointing across the whorl.

Fig. 1.—*Skeleton outline of the lobes of* Shirbuirnia.

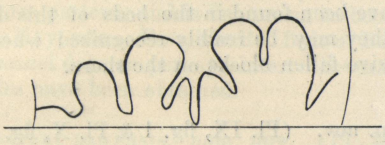
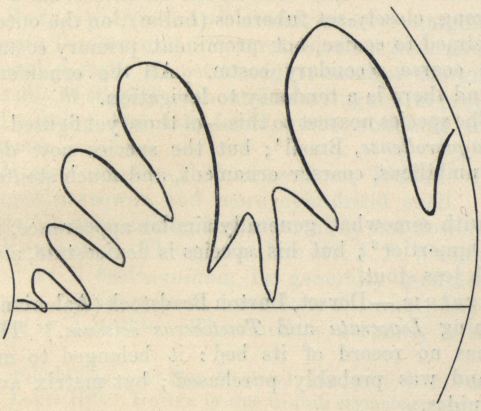


Fig. 2.—*Skeleton outline of the lobes of* Burtonia.



Distinction.—From its ally, *Hammatoceras*, the coarse ornament and the much less complex suture-line; from any of the Hildoceratidæ, to some genera of which it has superficial resemblance—to *Kiliania* for instance,—the retracted or dependent inner portion of the suture-line.

This genus belongs to a series entirely different from *Shirbuirnia*. The essential character is the retracted or dependent inner portion of the suture-line. Instead of the lobes appearing like so many protrusions from a straight line, as in fact the lobes of *Shirbuirnia* do, the inner portion of the suture-line

in *Burtonia* looks as if that part hung from a line which had fallen down at one end. Thus a line connecting the tops of the saddles in *Shirbuirnia* runs from the periphery nearly straight to the centre, while the lobes are almost at right angles to it and parallel to one another. But a similar line in *Burtonia* runs in an oblique curve; and, instead of the axes of the inner lobes being parallel with that of the superior lateral, they would, if produced, cut across the axis of this lobe and strike the periphery (see figs. 1 & 2, p. 97).

This retracted character of suture-line is found in the genera *Hammatoceras* and *Erycites*, to which *Burtonia* is most nearly allied. The first is a carinate genus like *Burtonia*; the second is not carinate. The character is found in the large uncarinate families Deroceratidæ and Stepheoceratidæ; and it may be concluded that the *Hammatoceras* series is akin to them,—is probably an offshoot of the Deroceratidæ. The character is not observed in the great carinate groups, the Sonnininæ and the Hildoceratidæ. In general appearance *Burtonia* is very like examples of these groups; and its possession of a carina makes the resemblance closer; but the lobe-character is the distinction.

Species of this genus characterize the strata of the *scissi* hemera. Most of the specimens have been found in the beds of this date at Burton Bradstock; and they may be readily recognized when seen protruding from the massive fallen blocks on the shore.

Burtonia crassornata, sp. nov. (Pl. IX, fig. 1 & Pl. X, fig. 1.)

Description.—Gradumbilicate; crassornate—inner marginal bullæ and coarse costæ; periphery concavifastigate, parvicarinate.

Remarks.—The inner whorls, as seen in the umbilicus, show a succession of very strong, closely-set tubercles (bullæ); on the outer whorl these have declined to coarse, not prominent primary costæ, whence proceed the coarse secondary costæ. All the ornament gradually declines, and there is a tendency to levigation.

Distinction.—The species nearest to this—of those yet figured—is *Hammatoceras feuguerollense*, Brasil[1]; but the species now described has a larger umbilicus, coarser ornament, and much stouter whorls.

Another species, with somewhat generally similar appearance, is *Ammonites alleoni*, Dumortier[2]; but his species is flexicostate, and its ornament is much less stout.

Locality and stratum.—Dorset, Burton Bradstock (Aalenian). [In the bed containing *Liocerata* and *Tmetoceras scissum*.] The figured specimen has no record of its bed: it belonged to my father's collection, and was probably purchased; but matrix and condition are good guides.

[1] 'Niveau à *Ammonites opalinus*' Bull. Soc. Géol. Normandie, vol. xv (1893–94) p. 39 & pl. v, figs. 1–2.

[2] 'Et. pal. Dép. jurass. Bassin du Rhône' pt. iv (1874) p. 259 & pl. lii, figs. 3 & 4.

Note.—*Hammatoceras feuguerollense* may certainly be placed in the genus *Burtonia*; and *Ammonites alleoni* would be more correctly placed there than in *Hammatoceras*; yet the different character of its ribbing may probably lead to separation even from *Burtonia*, when the species of these genera are better known.

III. Descriptions of Brachiopoda.

Terebratula burtonensis, sp. nov. (Pl. XII, figs. 11 & 12.)

Description.—A much inequivalved, incipiently biplicate Terebratulid. Dorsal valve rather flattened, ventral valve very gibbous. Lateral margin with curve projected dorsally in the anterior region; anterior margin with dorsally elevated, broad, median plication, which is only slightly sulcate—incipient biplication. Beak curved over, small, with small foramen hiding deltidial plates.

Distinction.—Is like *T. siderica*, S. Buckman,[1] but is a larger and more massive shell, more inequivalve and less biplicate.

Remarks.—Is apparently one of the *T. ventricosa-T. buckmani* series, which has attained to uniplication of the raised (dorsal) linguiform pattern, and is beginning to become biplicate.

Locality, etc.—From the Red Beds of Burton Bradstock (Dorset); about *sauzei* date or perhaps later. Several more or less complete examples have been obtained.

Terebratula lowensis,[2] nom. nov. (Pl. XII, figs. 9 & 10.)

1882. *Terebratula buckmani*, var. *buckmaniana*, S. Buckman (*non* Walker), Proc. Dorset Nat. Hist. & A. F.-C. vol. iv, p. 13.
1893. '*Terebratula buckmaniana*' Quart. Journ. Geol. Soc. vol. xlix, p. 489.

Description.—An obovoid, nearly equigibbous, incipiently biplicate Terebratulid. Ventral valve but little more tumid than dorsal, lateral margin almost straight, anterior margin only slightly and broadly M shaped, without dorsal linguiform projection. Beak short, not curving over the dorsal umbo, obliquely truncated by a small foramen.

Distinction.—*T. buckmaniana*, Walker[3] (in Davidson) is a longer, narrower, and more cylindrical shell. *T. perovalis*, Rothpletz,[4] is comparable, but is certainly not Sowerby's species.

Remarks.—Though the late Mr. J. F. Walker often spoke of this shell as *T. buckmaniana*, he generally qualified it as the Dorset form. Other students have done the same, and hence a distinctive name is desirable. The shell is certainly a development of the

[1] Proc. Cotteswold Nat. F.-C. vol. xiii (1901) p. 248 & pl. xiii, fig. 11.
[2] Louse Hill. Louse is due to folk etymology and the west-country habit of adding the sign of the genitive to place-names; it is not connected with a louse, but is low (Anglo-Saxon hláw, a hill), the same as in Ludlow, Bledlow. So it seems convenient to adopt the form *lowensis* for Low Hill.
[3] 'Brit. Jurassic Brach.' (Palæont. Soc.) Suppl. 1878, pl. xix, figs. 15, 17 only.
[4] 'Geol.-pal. Monogr. Vilser Alpen' Palæontographica, vol. xxxiii (1886) p. 100 & pl. ii, figs. 15–16 only.

Terebratula-buckmani series which is commencing biplication, and has proceeded very little with it. Its more equivalve shape and want of projection of the fold separate it from *T. burtonensis*.

Locality, etc.—The Irony Bed of Louse Hill (near Sherborne, Dorset), and of other quarries around, has produced this species in some abundance. It is of *blagdeni* date (Bajocian).

TEREBRATULA STIBARA,[1] sp. nov. (Pl. XII, figs. 5 & 6.)

Description.—A tumid, biplicate Terebratulid, with well-developed folds. Ventral valve rather more gibbous than dorsal. Lateral margin a good deal curved; anterior margin of a well-developed M shape. Folds and furrows reaching about half way up the valve, except the median ventral fold, which is more or less a continuous carina up to the beak. Beak short, stout, hardly overhanging the umbo, obliquely truncated by a medium-sized foramen.

Distinction.—*T. stephani*, Davidson, of which the type is figured in Proc. Dorset Nat. Hist. & Ant. F.-C. vol. i, pl. i, fig. 3 (1877), is a thinner, longer, and more biplicate shell, showing none of the tumid habit of this species.

Remarks.—This species is evidently a tumid development of the *T.-stephani* series, though hardly of that species itself. Its 'fatness' and rotundity make it a very distinct form.

Locality, etc.—Crewkerne Station (Somerset), Broad Windsor and Burton Bradstock (Dorset), have yielded various specimens in Mr. J. W. D. Marshall's collection and my own. They come from the 'top beds of the Inferior Oolite'; and have not been more accurately dated, for want of subdivisional names for these beds. The species is of about *schlœnbachi* date, perhaps *zigzag*, perhaps both.

TEREBRATULA VINNEYENSIS,[2] J. F. Walker, MS. (Pl. XII, figs. 7 & 8.)

Terebratula sphæroidalis, auctt. (pars).

Description.—A small, flattened, spheroidal Terebratulid with uniplication, the margin curved to form an inconspicuous though broad, dorsally projected, flattened fold. Beak somewhat large; foramen small; deltidial plates hidden.

Distinction.—*T. sphæroidalis*, J. de C. Sowerby, though so often quoted, is a species about which very little is known; and the specimens called by that name seldom agree with his figure. That species differs from the form now described by being more spheroidal, having 'the edges of its valves even' (Sowerby), a more dumpy beak, and valves not so flattened anteriorly (tapering, side view). *T. subsphæroidalis*, Upton,[3] is more in character with the present species, but that is more globose and has a small ∩ fold: the fold of Walker's species may be described as a flattened π fold.

Remarks.—The late Mr. J. F. Walker separated this form some

[1] στιβαρός, stout.

[2] Vinney Cross is the native name of what is called Vetney Cross, about 2 miles east of Bridport (Dorset).

[3] Proc. Cotteswold Nat. Hist. F.-C. vol. xiii (1899) p. 124 & pl. iii, figs. 5–7.

years ago, and with his usual kindness distributed specimens among his friends under this MS name, to which I have pleasure in giving effect as a small tribute to a generous friend. The figured specimen belongs to Mr. J. W. D. Marshall's collection, being one of a series of the species presented to him.

Locality, etc.—This small species occurs in some abundance in the top beds of the Inferior Oolite of Vinney (Vetney) Cross, of Burton Bradstock, and of other localities near Bridport (Dorset); it is also found at Broad Windsor, Bradford Abbas, Louse Hill, and many other places in Dorset and South Somerset. Its date is approximately *schlœnbachi*.

TEREBRATULA WHADDONENSIS,[1] nom. nov. (Pl. XII, figs. 15 & 16.)

1882. *Terebratula infra-oolithica*, S. Buckman (*non* E. Deslongchamps), Proc. Dorset Nat. Hist. & Ant. F.-C. vol. iv, p. 15.

Description.—A nearly circular, somewhat tumid, biplicate Terebratulid. Side-margin curved, and anterior margin forming a distinct **M** fold. Beak short, with distinct beak-ridges; it barely overhangs the dorsal umbo, and is well separated from it, showing rather wide deltidial plates; foramen small.

Distinction.—When compared with Deslongchamps's type-figure of *T. infra-oolithica*[2] and with specimens from Condé-sur-Sarthe, one of Deslongchamps's special localities, the English examples show several slight but noticeable differences. They are more circular, being less acuminate posteriorly, the beak and beak-area being broader, shorter and blunter; they are more tumid, especially the area of the dorsal umbo; they have a more curved side-margin and more distinct folds; while the beak has more distinct beak-ridges. But there is a further difference, that of punctation, although too little attention has been paid to this matter yet, and its significance is not understood. However, in *T. infra-oolithica* the punctæ are arranged in very close, slightly waving lines, the spaces between the lines being very narrow. In *T. whaddonensis* the punctæ are arranged in irregular waving lines, which are distinctly separated by plain spaces.

Locality, etc.—The species is fairly common in the sandy grit of Stoke Knap (Whaddon Hill) near Broad Windsor (Dorset), and at Little Silver near Haselbury (Somerset). It has occasionally been found at Chideock Quarry Hill and at Burton Bradstock, in the strata below the *scissum* bed. The date of the beds which yield *T. whaddonensis* has not been determined with the accuracy required for modern work, but *scissum-opaliniformis* expresses it approximately: they are apparently about on the line between the beds of these two dates. As *T. infra-oolithica* is said to come from *opalinus* beds by Deslongchamps, but from *murchisonæ* beds by Dr. Brasil (label with specimens), its date may really be *Ancolioceras*, and so there may be some difference in date between it and *T. whaddonensis*.

[1] Whaddon Hill is the native name for the eminence known as Stoke Knap.
[2] In A. d'Orbigny's 'Terr. Jur.: Brachiopodes' (Pal. franç.) pl. lvii, fig. 7.

TEREBRATULA ARENARIA, sp. nov. (Pl. XII, figs. 17 & 18.)

Description.—An obovate, inequigibbous, biplicate Terebratulid. Dorsal valve flattish, ventral valve gibbous, less so anteriorly. Side-margin curved, and anterior margin producing a distinct M fold. Beak short, stout, with indistinct beak-ridges; foramen somewhat small, with a labiate extension almost touching the umbo and hiding the deltidial plates.

Distinction.—When compared with *T. whaddonensis*, it is seen to differ in shape and proportions in many respects. *T. varicans*, Rothpletz [1] is a smaller, narrower, and for its age more plicate species; other figures differ still more.

Locality, etc.—In the same beds and localities as *T. whaddonensis*; but scarce.

AULACOTHYRIS CUCULLATA, nom. nov. (Pl. XII, figs. 1 & 2.)

1882. Shells like *Waldheimia meriani*, S. Buckman, Proc. Dorset Nat. Hist. & Ant. F.-C. vol. iv, p. 34.

Description.—A broad, short naviculoid, with a deep sulcus in the dorsal valve, and an elevated carina in the ventral. Beak curved over like a monk's cowl, strong beak-ridges, and a small foramen.

Distinction.—Resembles a dwarf *Aulacothyris meriani* (Oppel), but is much more sulcate for its size. Is a larger and more sulcate shell than *A. doultingensis*, Richardson, its possible ancestor.

Locality, etc.—In brown clay on the top of the *zigzag* bed of Grange Quarry, Broad Windsor (Dorset); not uncommon. Its date is therefore early *fuscæ* hemera, and it should be found in the Scroff or overlying Fullers' Earth Clay at Burton Bradstock.

ZEILLERIA WHADDONENSIS, sp. nov. (Pl. XII, figs. 13 & 14.)

Description.—An elliptical, tumid, smooth Dallinine, with an almost even margin, a tumid ventral valve posteriorly, a stout curved-over beak with strong ridges, a small incomplete foramen, and narrow deltidial plates.

Distinction.—*Zeilleria oppeli*, S. Buckman,[2] is a more circular and flatter shell, lacking the elongate character: that form agrees more with the young stage of the present shell.

Locality, etc.—Stoke Knap (Whaddon Hill) and Chideock Quarry Hill (Dorset), in the sandy grits with *T. whaddonensis*. *Z. oppeli* characterizes the Rusty Bed of Burton (see section, p. 74). The species now described might be expected in the same place or just below.

[1] 'Geol.-pal. Monogr. Vilser Alpen' Palæontographica, vol. xxxiii (1886) p. 97 & pl. iv, fig. 3 only.

[2] Quart. Journ. Geol. Soc. vol. lii (1896) p. 702.

ZEILLERIA LINGULATA, sp. nov. (Pl. XII, figs. 3 & 4.)

Description.—A subdiamond-shaped, somewhat flattened Dallinine, with the pointed anterior margin slightly projected dorsally like a little tongue. Both valves somewhat gibbous, the ventral more so than the dorsal. Growth-halts conspicuous at intervals. Beak-areas pronounced, flattened, broad; beak-ridges well defined. Foramen rather large, incomplete.

Distinction.—This shell is something like *Waldheimia emarginata*, Szajnocha [1]; but that does not resemble Sowerby's species. Prof. Szajnocha's shell has the same little 'turn up in front' (as it is generally called) as the species now described, whence the name *lingulata*; but that is not a character of Sowerby's shell.

Macandrewia disculus, Waagen,[2] is a rounder shell, with a less acuminate beak, a straight side-margin, and showing no sign of the anterior lingulate character.

Locality, etc.—Not uncommon in the top beds of the Inferior Oolite at Grange Quarry (Broad Windsor, Dorset). Scarce in the 'Top Beds' of Bradford Abbas (Dorset); and I have a note of a specimen similar to this species being found in the Coralline (Upper Coral) Bed (*truellii* zone) of Dundry, Somerset. The date of the species may be stated approximately as *schlœnbachi-truellii* hemeræ. It may confidently be looked for in the Top Beds of Burton Bradstock.

Note.—The growth-halts which impart to the shell a banded appearance, are very noticeable in some specimens, and seem to constitute a distinctive feature in combination with its other characters. They remind one of the growth-halts of the recent *Bouchardia*.

RHYNCHONELLA PENTAPTYCTA, sp. nov. (Pl. XII, figs. 19 & 20.)

Description.—A small, subglobular, tripartite costate Rhynchonellid, ornamented normally with about eleven well-marked ribs, of which three are on each lateral area and five are on the median area. The median fold of the dorsal valve projects above the lateral areas, anteriorly, so that the line of valve-junction uniting lateral and median areas is about twice as long on each side of the median area as it is between any rib and furrow. The sinus on the ventral valve is much sunken: lengthwise it forms a regular gibbous curve. The ribs are prominent, with deep furrows, and so the line of junction is strongly indented. The beak is small and short, the foramen small, hypothyrid, and touching the dorsal umbo: it is bounded laterally by small deltidial plates.

Distinction.—The deeply sinuated line of valve-junction is the most characteristic feature. There is nothing figured by Davidson like this shell: *Rh. moorei* [3] has quite different proportions,

[1] 'Die Brachiopoden-Fauna der Oolithe von Balin' Denkschr. k. Akad. Wissensch. Wien, vol. xli, pt. ii (1879) p. 214 & pl. iv, fig. 18 only.

[2] 'Zone des *Am. Sowerbyi*' Geogn.-Pal. Beiträge, vol. i, pt. 3 (1867) p. 638 & pl. xxxi, fig. 8; fig. 9 is more elliptical.

[3] 'Monogr. Brit. Jur. Brach.' (Palæont. Soc.) 1876, pl. xv, fig. 11.

and lacks the characteristic valve-junction. Nor is there any one among the small *Rhynchonellæ* figured from strata of about the date of our species by Botto-Micca [1] or Meneghini [2] that is comparable. *Rh. frontalis*, E. Deslongchamps,[3] is also about a contemporary, but it has a feeble likeness to the Dorset species: it has only ribs around the margin, differs in proportions, lacks the very sinuous valve-junction, and so on; nevertheless it forms its mesial fold in somewhat the manner of the Dorset form.

Remarks.—I discovered this interesting little species in the *aalensis* beds of the Bridport Sands of Chideock Quarry Hill in the year 1893, and have distributed specimens under the present name (or something similar) to various Brachiopodists, who, like the late Mr. J. F. Walker and Mr. Charles Upton, have since been able to confirm the horizon of the species.

Although the name *pentaptycta* is given for the five plaits on the dorsal fold, there is, of course, variability in this respect. Of 88 specimens collected during the first visit there were the following forms:—

Character.	*Number.*	*Per cent.*
With four plaits	15	17·5
five do.	29	33
six do.	27	30·5
seven do.	17	19

Locality, etc.—Chideock Quarry Hill, near Bridport (Dorset), in the upper part of the Bridport Sands, with fine-ribbed *aalensis*-like Ammonites (see section, stratigraphical paper, p. 60). Its date is, therefore, *aalensis* hemera (Aalenian). It occurs at various places round the hill where its bed is exposed; and would no doubt be found at Burton Bradstock, if the sands were accessible.

A few notes on certain species may be appended to these descriptions.

There are certain species of Brachiopods that are almost peculiar to the Irony Bed (*blagdeni* zone, Bajocian) of Louse Hill, near Sherborne (Dorset), and are hardly known anywhere else in this country, which are met with in the Untere Dogger vom Rothen Stein of the Vilser Alpen. They are as follows:—

Glossothyris bifida (Rothpletz). The author gives the name *Terebratula bifida* [4] to a form which he distinguishes from *T. curviconcha*, Oppel. Prof. Rothpletz's species is probably what we have been calling *Glossothyris curviconcha*=*T. curviconcha*, Davidson, App. to Suppl. (1884) pl. xviii, fig. 15.

[1] 'Foss. d. Strati à *L. opalinum*' Boll. Soc. Geol. Ital. vol. xii (1893) pp. 185 *et seqq.* & pl. i.

[2] 'Foss. ool. d. Mte. Pastello' Atti Sci. Tosc. Sc. Nat. vol. iv (1879) pl. xxii.

[3] 'Ét. crit. Brach. nouv.' Bull. Soc. Linn. Norm. vol. vii (1862) pl. v, p. 30 & figs. 7–8.

[4] 'Geol.-pal. Monogr. Vilser Alpen' Palæontographica, vol. xxxiii (1886) p. 114 & pl. v, figs. 17–19 (only).

WALDHEIMIA ANGUSTIPECTUS, Rothpletz.[1] Forms agreeing with his figs. 6, 7, 15, & 16 (pl. vii) have been found in the Irony Bed (*blagdeni* zone, Bajocian) of Louse Hill near Sherborne (Dorset). His fig. 12 of pl. vii appears to be similar to the *Waldheimia haasi*, S. Buckman (in Davidson, 'Mon. Brach.' App. to Suppl. 1884, pl. xix, fig. 11), also from the same place. Certainly *W. angustipectus* is a development of *W. haasi*, Davidson, pl. xix, fig. 12, through pl. xix, fig. 11, in the direction of losing the dorsal sulcation.

The *Waldheimia waltoni*, Rothpletz (*op. cit.* p. 123 & pl. vii, fig. 31), is not Davidson's species, but is very near to *Zeilleria ferruginea*, S. Buckman, 1901.[2] This is also from the Irony Bed of Louse Hill. To these apparently must be added *Terebratula lowensis*, described above (p. 99).

Another English species of the Vilser Alpen Dogger is characteristic in this country of a zone a little way lower down—the *discites* zone, see Table I (stratigraphical paper, p. 55). This species is

NORELLA LIOSTRACA (S. Buckman) = *Rhynchonella bilobata*, S. Buckman 1882, and Davidson 1884, which was, on account of the prior use of *bilobata*, named *Rhynchonella liostraca* by me, in Geol. Mag. dec. 3, vol. iii (1886) p. 217 (May). The same species was named by Prof. Rothpletz *Rh. securiformis* in December 1886.[3] As it is a reversed Rhynchonellid—dorsally instead of ventrally sulcate, it is more suitably placed as *Norella* than as *Rhynchonella*. It is a most singular species, belonging to the *discites* zone (Bajocian); and is very rare in this country. It does not seem to be common in the Vilser Alpen.

Prof. Rothpletz's work shows the necessity for the following change of name:—

RHYNCHONELLA CYMATOPHORINA, nom. nov. This name is to replace *Rh. cymatophora*, S. Buckman,[4] as *Rh. cymatophora* is preoccupied by Rothpletz, 1886.

In connexion with the species from the Irony Bed of Louse Hill, it may be noted that *Waldheimia böhmi*, Böse (in Parona),[5] has the most remarkable likeness to *Waldheimea brodiei*, S. Buckman (in Davidson),[6] which is a species from the Irony Bed (*blagdeni* zone).

The thin Irony Bed of Louse Hill, 2 to 3 inches thick, is one of the most remarkable repositories of Brachiopod species in

[1] *Op. jam cit.* p. 131.
[2] Proc. Cotteswold Nat. Hist. F.-C. vol. xiii (1901) p. 260 & pl. xiii, fig. 4.
[3] *Op. supra cit.* pl. ix, figs. 58 & 59.
[4] 'Bajocian of the Mid-Cotteswolds' Quart. Journ. Geol. Soc. vol. li (1895) p. 447.
[5] 'Fauna & Età degli Strati con *Posidonomya* Alpina' Pal. Ital. vol. i (1895) p. 31 & pl. ii, figs. 21–23.
[6] 'Monogr. Brit. Jur. Brach.' App. to Suppl. (Palæont. Soc.) 1884, p. 266 & pl. xix, figs. 14–15.

this country. They are, many of them, such distinctive and peculiar species, and in this country so geographically restricted. There are more to be described at some future opportunity. For details of Louse Hill and the Irony Bed, see Quart. Journ. Geol. Soc. vol. xlix (1893) p. 488.

[Addendum.—The biplicate *Rhynchonella* characteristic of the Sandy Grits of Stoke Knap (see stratigraphical paper, p. 76), which is figured as *Rh. stephensi*, Davidson = ? *cynocephala*, Richard (Quart. Journ. Geol. Soc. vol. li, 1895, pl. xiv, fig. 1), may possibly be *Rh. fidia*, d'Orbigny, Prodrome, 1849 [1850] p. 258.—*February 16th, 1910.*]

IV. Summary.

The following genera and species have been described or discussed in this paper:—

Ammonites.

New names in **heavy type.**

Bradfordia.
Bradfordia **costata.**
Bradfordia etheridgii.
Bradfordia **inclusa.**
Bradfordia **liomphala.**
Burtonia.
Burtonia **crassornata.**
Darellia **alta.**
Œcotraustes **spiniger.**
Œdania **obscura.**
Shirbuirnia.
Shirbuirnia stephani.
Shirbuirnia **trigonalis.**
Sonninia subtrigonata.

Brachiopoda.

The following species are described: new names in **heavy type.**

Aulacothyris **cucullata.**
Rhynchonella **pentaptycta.**
Terebratula **arenaria.**
Terebratula **burtonensis.**
Terebratula **lowensis.**
Terebratula **stibara.**
Terebratula **vinneyensis.**
Terebratula **whaddonensis.**
Zeilleria **lingulata.**
Zeilleria **whaddonensis.**

The following new name is given:—

Rhynchonella **cymatophorina.**

The following species are noted:—

Glossothyris bifida (Rothpletz).
Norella liostraca (S. Buckman).
Rhynchonella fidia, d'Orbigny.
Waldheimia angustipectus, Rothpletz.
Waldheimia böhmi, Böse.
Waldheimia waltoni, Rothpletz.

EXPLANATION OF PLATES IX-XII.

Plate IX.

Aalenian: *scissum* zone.

Fig. 1. *Burtonia crassornata*, sp. nov. (Holotype.) See p. 98. Side view × 0·7. [*scissum* bed], Burton Bradstock (Dorset). From my father's collection. Photogr. J. W. Tutcher. (See also Pl. X, fig. 1.)

Bajocian: post-*discites* zone.

Figs. 2 & 3. *Bradfordia inclusa*, sp. nov. (Holotype.) See p. 94.—Fig. 2: Side view, natural size. Fig. 3: Front view. From the Building-Stone, presumably the top layer, Stoke Knap (Dorset).

Bajocian: *discites* zone.

Figs. 4 & 5. *Œdania obscura*, sp. nov. (Holotype.) See p. 96. Photogr. Author. Fig 4: Side view, natural size. Fig. 5: Front view (outline). From the upper part, judging by the matrix, of the Fossil Bed of Bradford Abbas (Dorset).

Plate X.

Aalenian: *scissum* zone.

Fig. 1. *Burtonia crassornata*, sp. nov. (See p. 98.) Front view × 0·7. See also Pl. IX, fig. 1.

Bajocian: *Skirburnia* Zone.

Figs. 2 & 3. *Shirburnia trigonalis*, sp. nov. (Paratype.) See p. 92.—Fig. 2: Side view (portion) × 0·86. Fig. 3: Front view × 0·61. From the lower part of the Fossil Bed of Sandford Lane, Sherborne (Dorset). Photogr. Miss Buckman.

Bajocian: *discites* zone.

Figs. 4 & 5. *Bradfordia liomphala*, sp. nov. (Holotype.) See p. 94.—Fig. 4: Side view, natural size. Fig. 5: Front view. From the upper part of the Fossil Bed of Bradford Abbas (Dorset). Photogr. Miss Buckman.

Fig. 6. *Bradfordia costata*, sp. nov. (See p. 94) Peripheral view. See also Pl. XI, fig. 1.

Plate XI.

Bajocian: *discites* zone.

Fig. 1. *Bradfordia costata*, sp. nov. (Holotype.) See p. 94. Side view, natural size. From the upper part of the Fossil Bed of Bradford Abbas (Dorset). Photogr. Miss Buckman. (See also Pl. X, fig. 6.)

Figs. 2 & 3. *Darellia alta*, sp. nov. (Holotype.) See p. 96.—Fig. 2: Side view, natural size, photogr. Author. Fig. 3: Outline section. From the Lower *Trigonia* Grit, Frith Quarry, Painswick (Gloucestershire).

Bajocian: *sauzei* zone.

Figs. 4–6. *Sonninia subtrigonata*, S. Buckman. (Holotype.) See p. 93.—Fig. 4: Side view, natural size. Fig. 5: Front view. Fig. 6: Portion of peripheral view, to show alticarina:—all photogr. J. W. Tutcher. From the upper part of the Fossil Bed, Sandford Lane, Sherborne (Dorset).

Fig. 7. *Œcotraustes spiniger*, sp. nov. (Holotype.) See p. 95. Side view. From the Marl Bed with green grains, Frogden Quarry, Oborne (Dorset). Photogr. Miss Buckman.

Plate XII.

[All the figures in this Plate are reproduced from photographs by Mr. J. W. Tutcher, and are of the natural size.]

Bathonian: *fusca* zone.

Figs. 1 & 2. *Aulacothyris cucullata*, sp. nov. (See p. 102.) Holotype, from the clay (Fullers' Earth) immediately above the Inferior Oolite limestone (*zigzag*), Grange Quarry, Broad Windsor (Dorset).

Bathonian: circa *schlœnbachi* zone.

Figs. 3 & 4. *Zeilleria lingulata*, sp. nov. (See p. 103.) Holotype, from the 'Top Beds,' Broad Windsor (Dorset).

Figs. 5 & 6. *Terebratula stibara*, sp. nov. (See p. 100.) Holotype, from the 'Top Beds' of Crewkerne Station (Somerset).

Figs. 7 & 8. *Terebratula vinneyensis*, Walker MS. (See p. 100.) Lectotype, one of his syntypes, from the 'Top Beds,' *schlœnbachi* or *truellii* zone, Vetney (Vinney) Cross, near Bridport (Dorset). Collection of Mr. J. W. D. Marshall.

Bajocian: *blagdeni* zone.

Figs. 9 & 10. *Terebratula lowensis*, nom. nov. (See p. 99.) Holotype, from the Irony Bed of Louse Hill, near Sherborne (Dorset).

Bajocian: circa *sauzei* zone.

Figs. 11 & 12. *Terebratula burtonensis*, sp. nov. (See p. 99.) Holotype, from the Red Beds of Burton Bradstock.

Aalenian: *scissum-opaliniforme* zone.

Figs. 13 & 14. *Zeilleria whaddonensis*, sp. nov. (See p. 102.) Holotype, from the Sandy Grits of the roadside ascent of Stoke Knap (Whaddon Hill), Broad Windsor (Dorset).

Figs. 15 & 16. *Terebratula whaddonensis*, nom. nov. (See p. 101.) Holotype from the same strata and locality.

Figs. 17 & 18. *Terebratula arenaria*, sp. nov. (See p. 102.) Holotype from the same strata and locality.

Aalenian: *aalensis* zone.

Figs. 19 & 20. *Rhynchonella pentaptycta*, sp. nov. (See p. 103.) Holotype, from the Bridport Sands with *Canavarina*. See section I, p. 64. Ascent of Chideock Quarry Hill, Bridport (Dorset).

ŒDANIA OBSCURA

BRADFORDIA INCLUSA

BURTONIA CRASSORNATA

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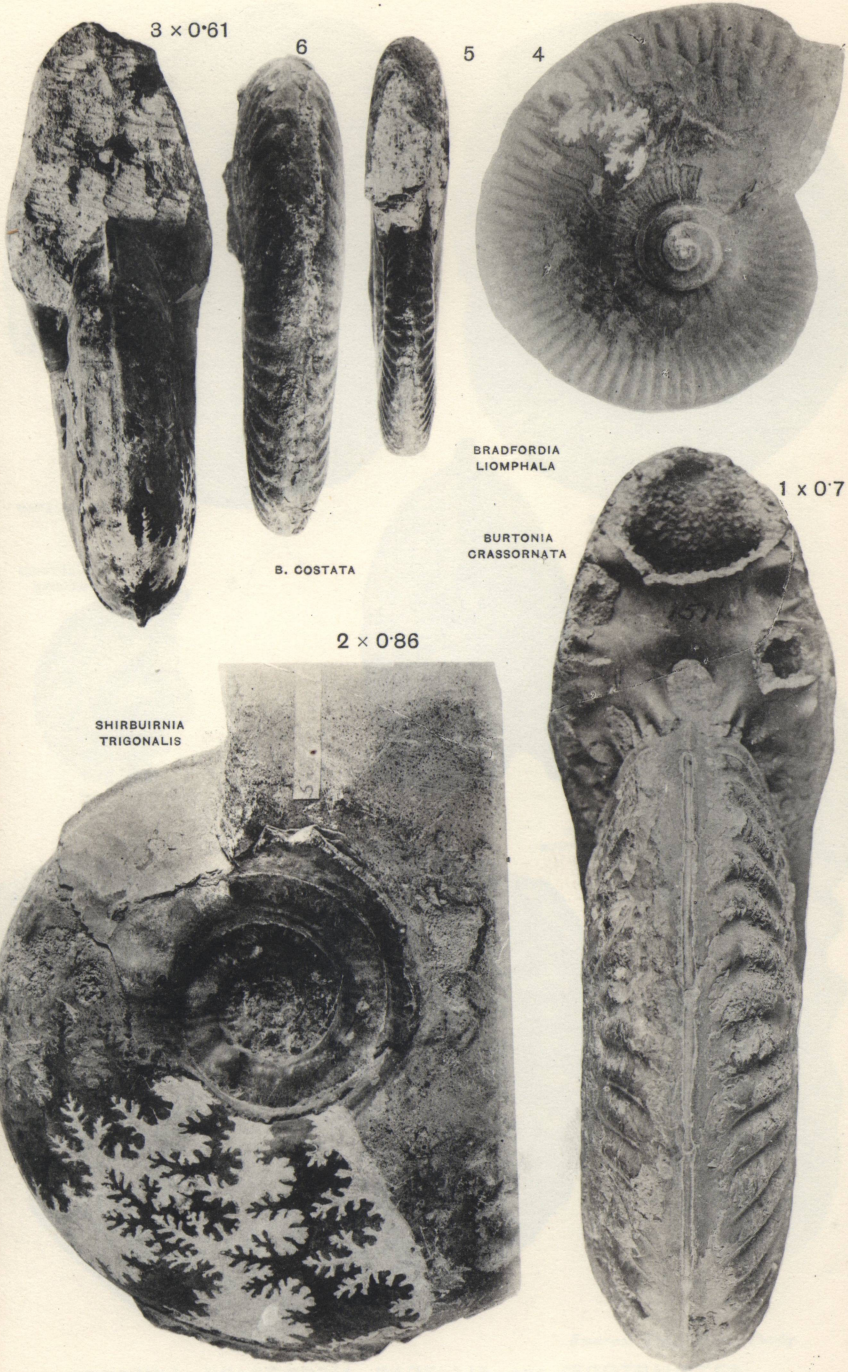
BURTONIA, BRADFORDIA, AND ŒDANIA



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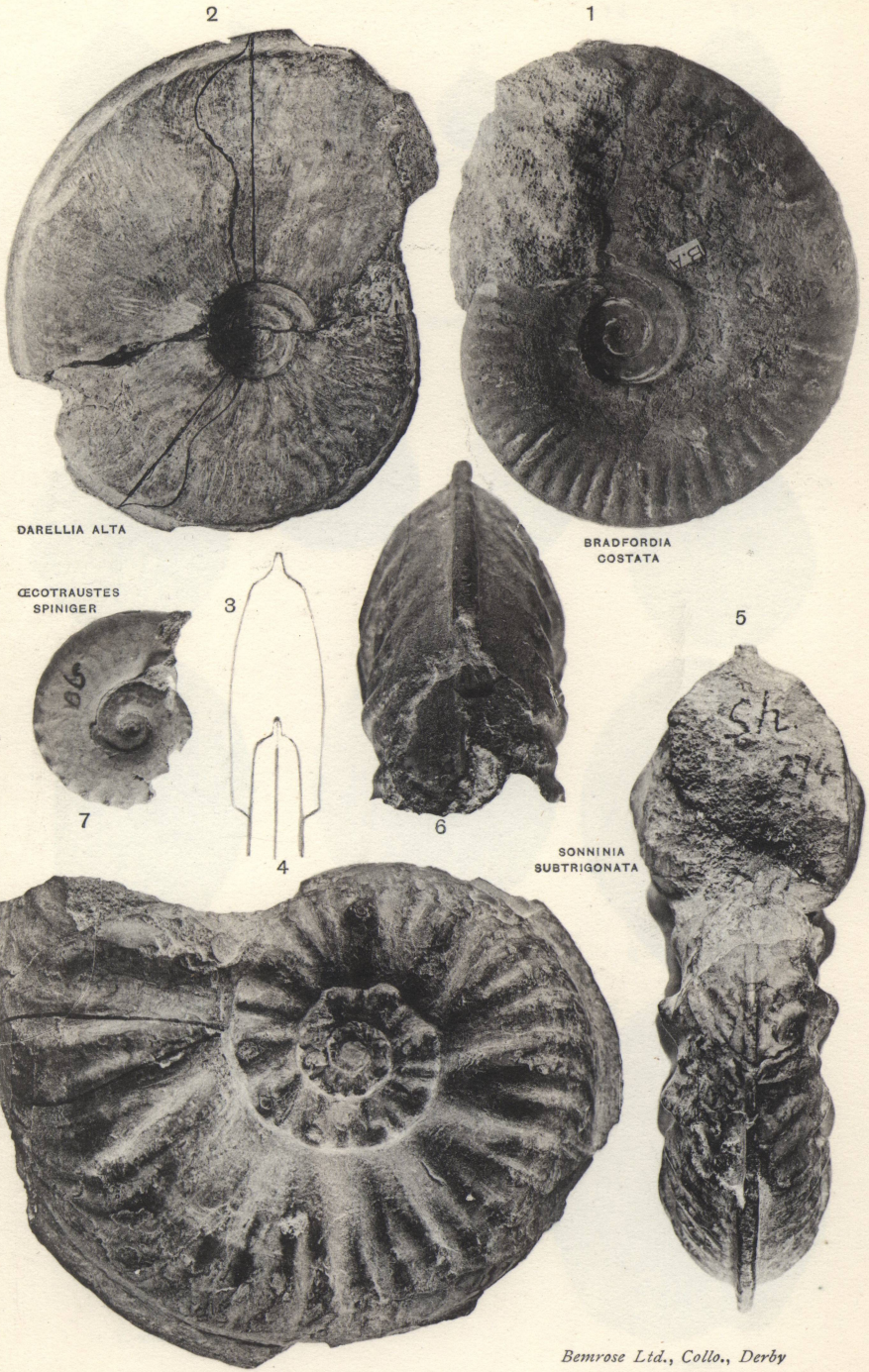
BURTONIA, SHIRBUIRNIA, AND BRADFORDIA



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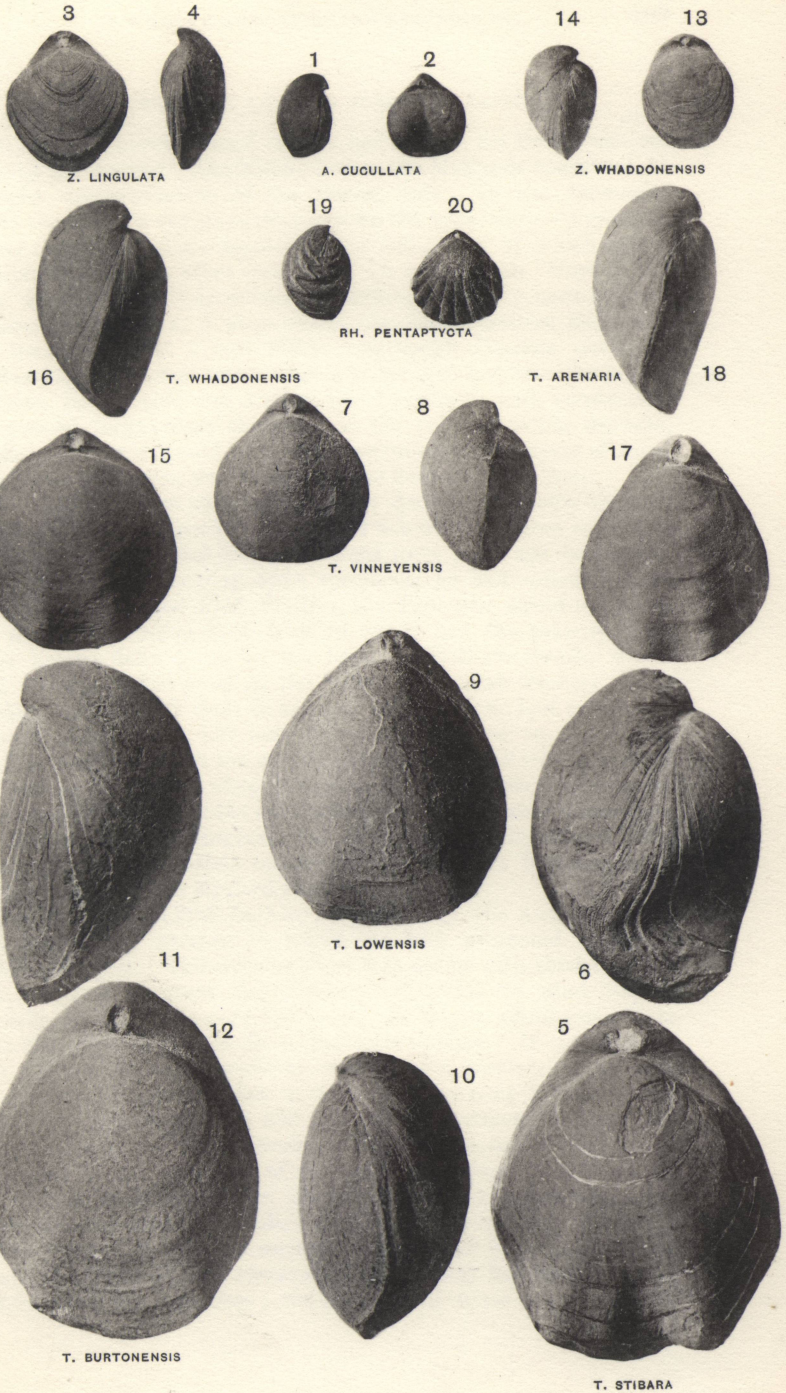
SONNINIA, BRADFORDIA, DARELLIA, AND ŒCOTRAUSTES



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BRACHIOPODA

Discussion [on the two foregoing papers].

Mr. E. A. Walford stated that he had studied the Dorset sections cited by the Author. The Middle Lias in the Midlands contained, he thought, representatives of the Dorset beds. In the Ammonite fauna there was a complete change from the beds below—signifying a long interval of slight deposition, the full record of which might possibly be found in other countries. In a paper on 'Gaps in the Lias' the speaker had described the welding of three Liassic zones—*Ammonites communis*, *A. serpentinus*, and the Transition Bed—into one limestone-block 2 feet thick. Although familiar with the Chideock Hill quarries many years ago, he had not seen the higher Bajocian beds which the Author had described; and, considering the general fragmentary character of the Inferior Oolite deposits, he thought that it would be wise to restrain much increase of zonal definitions until more was known, and to keep to broad lines.

Mr. James Parker observed that the Author repeatedly referred to the Bridport Sands. He would ask whether these were now reckoned as a geological division. Some forty years ago he remembered that, when showing some specimens he had collected from those beds to the late Prof. Phillips, the Professor would not allow the name, contending that Midford Sands had the priority, that name having been given to the beds by William Smith, whom Prof. Phillips looked upon as the father of English Geology. The speaker further said that, in arguing the point, he had considered that the thickness of 150 feet of the bed exposed on the Dorset coast, as compared with the very slight exposure at Midford, entitled the beds to be named after Bridport, just as the clay-beds on the same coast a few miles to the east had received the name of Kimeridge, and that not only in England, but in France and elsewhere. He asked whether the Author considered the sands at Bridport to be the equivalent of the Midford Sands.

The President (Prof. Sollas) congratulated the Author on the very interesting manner in which he had presented a highly technical subject. The correlation of thin seams with thick deposits was a matter of great importance, and called to mind Suess's remarks on the partings in the Trias. It might afford some hints as to the order of magnitude of the scale of time. If we assumed that 1 foot of sediment might accumulate in a century, in an area of maximum deposition, then in the case of the seam 2 inches thick which was represented by 250 feet in the Cotteswolds, the rate of formation would be less probably than 1 foot in 150,000 years. In regard to the existence of the numerous zones traced out by the Author, he thought that observation should be extended over wider areas in order to establish them on a firm basis.

The Author, in reply, remarked that Jurassic zones were by no means the result of local observation only: they had been followed widely, even the new ones; the thinness of zones was no test of

their importance or otherwise, being often only a local accident of alternating deposition and denudation. The net increase of deposit must have been much less than 1 foot in a century, as this seemed too rapid for the faunal changes involved. In conclusion, the Author begged the Fellows to accept his thanks for their kind reception of his papers.

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[No. 262 of the Quarterly Journal will be published next May.]

[The Editor of the Quarterly Journal is directed to make it known to the Public that the Authors alone are responsible for the facts and opinions contained in their respective Papers.]

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